Flue Gas Cleanup Using a Novel Corona Generator

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Abstract

The work reported here describes the testing of a novel corona discharge flue gas reactor, designed to oxidize mercury vapor at the low concentrations found in power plant flue gas. The oxidation of elementary mercury vapor to the more soluble mercuric oxide allows it to be captured in an existing downstream wet scrubber control device used for sulfur dioxide control.

A corona discharge in flue gas produces oxidizing radicals, such as OII and atomic oxygen, which then react to oxidize flue gas constituents. Optimum performance demands that the corona discharge, and hence the oxidizing radicals, be uniformly distributed within the reactor. A unique corona reactor in which corona is generated intensely and uniformly has been designed, and the demonstration of its performance was the principal objective for this project.

The evaluation of the corona reactor took place at small scale in the laboratory and at pilot scale at Alabama Power's Miller Steam Plant. The results showed that the spatially distributed corona discharge produced by the corona reactor operating at short residence times will yield a high level of mercury vapor oxidation. In addition, several ppm of sulfur trioxide are also generated with the application of the corona discharge. The SO_3 thus produced can provide flue gas conditioning for electrostatic precipitator enhancement.

Economic analysis indicates that this method of power plant mercury control is very competitive with the only other method of mercury control, adsorption by activated carbon. If mercury control regulations are promulgated for coal burning power plants, the corona discharge technology can potentially save over 2 million dollars per year in the production of 100 MW of electricity, when compared to the use of activated carbon.